

LETTER

REPLY TO VAN PEER:

Direct radiocarbon dating and ancient genomic analysis reveal the true age of the Neanderthals at Spy Cave

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Van Peer (1) contests the conclusions of our article on Neanderthal disappearance in Northwest Europe (2), but we think his argument may reflect a misunderstanding of the stratigraphy at Spy Cave and/or incomplete reading of our article. We provide here a response to his arguments.

The idea that the discovery time of the Neanderthal bones impacts the results is not scientifically valid and indicates an incomplete review of the literature. Among the oldest radiocarbon dates obtained on the Spy Neanderthals are those measured on collagen from material collected on the slope: Spy 737a (OxA-10560) and Spy 94a (GrA-32623) (3, 4). In addition, although found on the slope, the maxillary fragment and the attached molar refit with the maxilla from the original collection excavated in 1886 as described and illustrated in figure 2B of ref. 2.

Van Peer argues that we rejected the young dates on the scapula Spy 572a "on the grounds of probable contamination." However, we demonstrated, using genomic analysis, that all dates on Spy 572a are younger than those of the other Neanderthal specimens because a modern collagenous glue made from bovid was applied on this specimen. Therefore, all the radiocarbon dates of Spy 572a are inaccurate, even those made on hydroxyproline (HYP).

The attribution of the remains to Spy I or Spy II is not the subject of our article. These attributions, discussed since the discovery of the bones in 1886, are the subject of ongoing research by Rougier and

colleagues. Given the high level of uncertainty for assigning the bones to any individual, it is not reasonable to raise any stratigraphic argument for Spy I and Spy II. The only data we have, so far, to discuss their contemporaneity are the dates obtained on collagen extracted from teeth of each individual (Spy 92b and Spy 94a). These dates suggest the contemporaneity of both individuals (3, 4). Redating of these specimens with the HYP method (5) would be ideal, but this would require resampling.

A reworked position of Spy I is probable and unfortunately unverifiable. The argument proposed by Van Peer that mentions the presence of an erosive facies on the terrace is a misunderstanding of the literature. Indeed, the reworked sediment that Van Peer attributes to a natural erosive process (3? in figure 1A of ref. 1) is in fact the backfill from previous excavations, as de Loë and Rahr state in their publication (6). The stratigraphic units and their succession that Van Peer refers to in his letter vary greatly from one publication to another (7). These approximations raise questions on their relevance to the present discussion.

Finally, Van Peer argues that Neanderthals possibly lived more recently in the Meuse Valley than the individuals from Spy, Fonds-de-Forêt, and Engis. The discovery of more recent Neanderthal fossils may indeed, in the future, challenge the conclusions of our study. In addition to human remains, bone tools and/or faunal remains bearing anthropogenic

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modifications are the only elements that can be validly dated as they can be associated with archaeological material. We are currently dating these cultural witnesses, and more particularly bone tools.

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